

## ABSTRACT OF THE DISCLOSURE

Methods and materials are described for the joining of plastics and other materials wherein polymerizable substances are diffused into the material to form a surface diffusion zone adjacent to the surface of the plastic workpiece to be joined. The surfaces are brought into contact and the polymerization reactions in the surface diffusion zone are initiated, creating thereby a strong bond across the contacting surfaces.

High-performance engineered plastics such as polyetherimides, polyphenylenes, and polyether-ether-ketones are among the materials that are advantageously joined by this technique. Polymerizable substances including styrene and divinylbenzene are shown to give good bonds. Such joining methods can bond dissimilar materials difficult or impossible to join by other techniques. The surfaces to be joined are dry prior to initiation of the polymerization reaction, permitting repositioning and realignment of the surfaces as often as desired before joining. The present joining techniques do not clog or interfere with the structure of microfeatures on the surface of the workpieces to be joined, making this joining techniques especially advantageous for the fabrication of microfluidic devices. Such devices fabricated from high-performance engineered plastic joined by the present bonding techniques are shown to be capable of routine operation at high pressures and to withstand high-pressure cycling without damage.

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